

CLAIMS

1. A semiconductor device comprising electrodes formed on a semiconductor chip, and bumps each consisting of a spherically formed low melting point metal ball having a given size, and adhesive bonded to the electrodes.

2. The semiconductor device according to claim 1, wherein the low melting metal balls are adhesive bonded to the electrodes with a flux.

3. The semiconductor device according to claim 1 or 2, wherein the electrodes are formed from an electrode material of Cu or a Cu alloy, Al or an Al alloy, or Au or a Au alloy.

4. The semiconductor device according to claim 3, wherein the electrodes each comprise a layer of an electrode material composed of Al or an Al alloy, and at least one metal layer or metal alloy layer laminated to the electrode material layer and having a melting point higher than the electrode material.

5. The semiconductor device according to claim 4, wherein the at least one layer laminated to the electrode material layer is formed from a metal selected from Ti, W, Ni, Cr, Au, Pd, Cu, Pt, Ag, Sn or Pb or an alloy of these metals.

6. The semiconductor device according to claim 5, wherein the at least one layer laminated to the electrode material and contacted with the electrode material layer is formed from Ti, W, Ni, Cr, Pd, Cu or Pt, or an alloy of these metals, and the at least one layer farthest from the electrode material layer contacted with the low melting point metal ball is formed from Ni, Au, Pd, Cu, Pt, Ag, Sn or Pb, or an alloy of these metals.

~~7. A process for producing a semiconductor device comprising electrodes formed on a semiconductor chip, and bumps each consisting of a low melting point metal ball spherically formed, having a given size and adhesive bonded to the electrodes, the process comprising adhesive~~

bonding the low melting point metal balls to the electrodes with a flux.

8. The process according to claim 7, wherein the flux is applied to the electrodes.

a 5 9. The process according to claim 7 ~~or 8~~, wherein the low melting point metal balls are adhesive bonded to the electrodes by a process comprising the steps of:

10 applying a vibration at a small amplitude to a vessel containing the low melting point metal balls to cause the low melting point metal balls to jump up; arranging and holding the low melting point metal balls on an arrangement base plate by attracting the jumping up low melting point metal balls to attraction openings provided in the arrangement base plate in  
15 positions corresponding to the electrodes of the semiconductor chip to which the low melting point metal balls are to be adhesive bonded;

20 removing excess low melting point metal balls adhering either to the arrangement base plate or to the low melting point metal balls attracted to the attraction openings; and

simultaneously contacting the low melting point metal balls held and arranged on the arrangement base plate with the electrodes of the semiconductor chip.

25 10. A process for producing a semiconductor device provided with low melting point metal bumps on a semiconductor chip, the process comprising the steps of:

30 adhesive bonding low melting point metal balls each being spherically formed and having a given size to the electrodes, and

reflowing the low melting point metal balls.

11. The process according to claim 10, wherein the low melting point metal balls are adhesive bonded to the respective electrodes with a flux.

35 12. The process according to claim 11, wherein the flux is applied to the electrodes.

a ~~13. The process according to <sup>claim 10</sup> any one of claims 10 to~~  
a ~~12,~~ wherein the low melting point metal balls are adhesive  
bonded to the electrodes by a process comprising the steps  
of:

5 applying a vibration at a small amplitude  
to a vessel containing the low melting point metal balls  
to cause the low melting point metal balls to jump up;  
arranging and holding the low melting point  
metal balls on an arrangement base plate by attracting the  
10 jumping up low melting point metal balls to attraction  
openings provided in the arrangement base plate in  
positions corresponding to the electrodes of the  
semiconductor chip to which the low melting point metal  
balls are to be adhesive bonded;

15 removing excess low melting point metal  
balls adhering either to the arrangement base plate or to  
the low melting point metal balls attracted to the  
attraction openings; and

20 simultaneously contacting the low melting  
point metal balls held and arranged on the arrangement  
base plate with the electrodes of the semiconductor chip.

14. A semiconductor device produced by the process  
according to any one of claims 7 to 9, and provided with  
bumps consisting of low melting point metal balls and  
25 adhesive bonded to the respective electrodes of a  
semiconductor chip.

15 A semiconductor device produced by the process  
a according to <sup>claim 10</sup> ~~any one of claims 10 to 13,~~ and provided with  
bumps consisting of low melting point metal on the  
30 ~~electrodes of a semiconductor chip.~~